CONSTANT CURRENT DIGITAL TO ANALOG CONVERTER SYSTEMS AND METHODS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application No. 62/907,444, entitled "Constant Current Digital To Analog Converter Systems And Methods," filed on Sep. 27, 2019, which is incorporated herein by reference in its entirety for all purposes.

BACKGROUND

[0002] This disclosure generally relates to digital to analog converters (DACs).

[0003] This section is intended to introduce the reader to various aspects of art that may be related to various aspects of the present techniques, which are described and/or claimed below. This discussion is believed to be helpful in providing the reader with background information to facilitate a better understanding of the various aspects of the present disclosure. Accordingly, it should be understood that these statements are to be read in this light, and not as admissions of prior art.

[0004] Numerous electronic devices—including televisions, portable phones, computers, wearable devices, vehicle dashboards, virtual-reality glasses, and more—utilize DACs to generate analog electrical signals from digitally coded data. For example, an electronic device may use one or more DACs to drive pixels of an electronic display at specific voltages based on digitally coded image data to produce the specific luminance level outputs to display an image. In some scenarios, different output voltages of a DAC may draw different amounts of current from the power supply feeding the DAC. However, the power supply feeding the DAC may also supply power to one or more other components of the electronic device. Moreover, changes in current draw of the DAC may cause oscillations in the voltage of the power supply, which may have adverse effects (e.g., voltage inaccuracies) on the DAC output and/or for the other components of the electronic device that may be sensitive to changes in input voltage. Such effects may manifest as malfunctions or undesirable artifacts displayed on the electronic display.

SUMMARY

[0005] A summary of certain embodiments disclosed herein is set forth below. It should be understood that these aspects are presented merely to provide the reader with a brief summary of these certain embodiments and that these aspects are not intended to limit the scope of this disclosure. Indeed, this disclosure may encompass a variety of aspects that may not be set forth below.

[0006] An electronic device may use one or more digital to analog converters (DACs) to convert digitally coded data (e.g., coded via binary code, grey-code, thermometer code, etc.) to a corresponding analog output voltage. In some embodiments, the DAC may include a resistor ladder to vary the output voltage by changing the impedance before and/or after (e.g., with respect to current flow) an output node to the power supply and ground, respectively. For example, switches (e.g., transistors) may be used to connect or disconnect a supply voltage (e.g., VDD) at locations in the resistor ladder before the output node and to connect or disconnect a ground (e.g., VSS) at locations in the resistor ladder after the output node.

[0007] Moreover, in some embodiments, the switches may be utilized to increase and/or decrease the impedance before and after the output node such that the total impedance between the supply voltage and the ground remains approximately the same regardless of output voltage. For example, to increase the output voltage at the output node, one or more switches may be turned on before the output node to decrease the impedance between the supply voltage and the output node. Additionally, switches may be operated to increase the impedance between ground and the output node to effectively move the output node "up" the resistor ladder to a higher output voltage, while maintaining a constant total impedance between the supply voltage and the ground.

[0008] Additionally, in some embodiments, the DAC may be coded using thermometer coding. The thermometer coding may facilitate simplified operation of the switches by correlating each digit of the string of digital data to one or more switches, such that, for example, as the thermometer coded digital data increases in value by 1, one switch is turned on and one switch is turned off. Additionally, in some embodiments, thermometer coding may also reduce the likelihood of bit-to-bit skew. As such, by varying the impedance of different sections of the resistor ladder and/or by utilizing thermometer coding, a DAC of an electronic device may generate analog outputs that are less susceptible to error and/or have a more uniform current draw on the power supply, which may lead to less variation in the power supply voltage level.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Various aspects of this disclosure may be better understood upon reading the following detailed description and upon reference to the drawings in which:

[0010] FIG. **1** is a block diagram of an electronic device that includes a digital to analog converter, in accordance with an embodiment;

[0011] FIG. **2** is an example of the electronic device of FIG. **1**, in accordance with an embodiment;

[0012] FIG. **3** is another example of the electronic device of FIG. **1**, in accordance with an embodiment;

[0013] FIG. **4** is another example of the electronic device of FIG. **1**, in accordance with an embodiment;

[0014] FIG. **5** is another example of the electronic device of FIG. **1**, in accordance with an embodiment;

[0015] FIG. **6** is a diagrammatic representation of a digital to analog converter in electrical communication with an electronic display, in accordance with an embodiment;

[0016] FIG. **7** is a diagrammatic representation a digital to analog converter and other components of an electronic device, in accordance with an embodiment;

[0017] FIG. **8** is a flowchart of an example operation of a digital to analog converter, in accordance with an embodiment;

[0018] FIG. **9** is a diagrammatic representation of a digital to analog converter, in accordance with an embodiment;

[0019] FIG. **10** is a diagrammatic representation of a digital to analog converter, in accordance with an embodiment;

[0020] FIG. **11** is a diagrammatic representation of a digital to analog converter, in accordance with an embodiment;